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NOTES ON GEOGRAPHIC DISTRIBUTION

Filling gaps in the southern range of the Endangered Chacoan Peccary, *Parachoerus wagneri* (Rusconi, 1930) (Artiodactyla, Tayassuidae), in Argentina

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Abstract. New records of the Endangered *Parachoerus wagneri* (Rusconi, 1930) are reported in northwestern Córdoba and south Santiago del Estero, Argentina. These records were obtained through interviews, confirmed with photographical evidence provided by the interviewees, and trail camera surveys. These findings confirm the presence of this species in strategic areas of its distribution and provide evidence of potential connection between northern and southern populations in Argentina. Participatory sampling is proving to be an essential tool for gathering high quality information in these areas, thus has become crucial in obtaining records and clarifying the distribution of *P. wagneri*.

Key words. Biological corridors, coexistence, distribution, Dry Chaco, ethnozoology, flagship species, participative conservation

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INTRODUCTION

Parachoerus wagneri Rusconi, 1930, Chacoan Peccary (Mammalia, Artiodactyla, Tayassuidae), is endemic to the Chaco of Argentina, Bolivia, and Paraguay (Mayer and Wetzel 1986). The Gran Chaco region is one of the dry forest systems globally most threatened due to extensive deforestation and fragmentation primarily driven by the rapid expansion of industrial agriculture (Kuemmerle et al. 2017; Nanni et al. 2020). Intensive agriculture not only replaces natural ecosystems but also reduces landscape connectivity, posing significant challenges to wildlife (De la Sancha et al. 2021). Considering the synergistic impacts of deforestation in a forest-specialist species and commercial hunting in some areas, *P. wagneri* is under threat (Ceballos et al. 2015; Camino and Torres 2019). It is estimated that the species may persist for fewer than six generations without prompt action (Camino et al. 2022). For these reasons *P. wagneri* is classified as Endangered both globally (Altrichter et al. 2015) and in Argentina (Camino and Torres 2019), and in Córdoba province, central Argentina, it is considered Critically Endangered (Torres and Tamburini 2018). This status has established it a flagship species for biodiversity conservation in the Gran Chaco (Camino et al. 2022; Torres et al. 2023). This territorial species has social behavior, forming groups averaging nine members and have a diet rich in cacti, roots, leaves, and fruits (Mayer and Wetzel 1986; Camino 2016; Altrichter et al. 2017; Merlo and Boaglio 2022). Although this species mainly lives in primary forests, it is also found in secondary forests, indicating some compatibility with human land use, as long as this use does not imply high deforestation (Camino et al. 2022).

Determining the distribution of *P. wagneri* has been challenging due to its resemblance to the *Dicotyles tajacu* (Linnaeus, 1758) (Collared Peccary), which often leads to confusion in sightings (Torres and Tamburini 2018). Initially, these challenges were addressed by interviewing local hunters, whose knowledge helped distinguish between these two species (Altrichter and Boaglio 2004). More recently, reports have shown that local knowledge remains crucial for this task, particularly through interviews and the collection of animal physical remains such as skulls, hides, and hair. Combined with the use of trail cameras, these methods are among the most reliable for detecting *P. wagneri* (Torres et al. 2017, 2019; Camino et al. 2020; Neme et al. 2021).

This species was formerly known to inhabit the Chacoan forests of Bolivia, Paraguay, and northern Argentina. It was believed that the distribution of *P. wagneri* in Argentina extended from eastern Salta, through western Formosa and Chaco, to northern Santiago del Estero (Mayer and Wetzel 1986; Altrichter et al. 2015).

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Recent findings confirm the presence of *P. wagneri* in central Argentina in western Córdoba and eastern La Rioja, further extending the species' known geographic range (Torres et al. 2017, 2019; Camino and Torres 2019). However, the lack of records in northern Córdoba and nearby areas in Santiago del Estero suggested a potential disconnection between northern and southern Chacoan Peccary Argentine populations, raising concern about possible isolation, which would be a serious issue for the species southern populations (Ceballos et al. 2015; Torres et al. 2017; Camino and Torres 2019). In this report we provide new records in northern Córdoba and southern Santiago del Estero, highlighting areas that may serve as biological corridors linking northern and southern populations and emphasizing the importance of these findings for the development of actions for the future conservation.

METHODS

The study was conducted on 14 private farms, covering an area of 617 km², situated along the edges of the Salinas de Ambargasta salt pan (Figure 1; 29°30′21.78″S, 064°20′59.50″W). This area is in the Sobremonte Department in northern Córdoba province and the Ojo de Agua Department in southern Santiago del Estero province, in the southern portions of the Dry Chaco ecoregion in Argentina (Burkart et al. 1999). It is part of the Arid Chaco Subregion, which is characterized by a pronounced water deficit due to high temperatures and low annual rainfall (300–500 mm; Oyarzabal et al. 2018). Under optimal conditions, the upper stratum of the native vegetation can reach up to 12 m in height, dominated by trees such as *Aspidosperma quebracho-blanco* Schltdl., *Neltuma flexuosa* Hughes & Lewis., *Strombocarpa torquata* Hutch., and *Sarcomphalus mistol* (Griseb.), and the cactus *Stetsonia coryne* Britton & Rose. Below them, the shrub stratum ranges between 3 and 4 m in height, with *Mimozyganthus carinatus* (Griseb.) Burkart., *Larrea divaricata* Cav., and *Parkinsonia praecox* Hawkins. as the dominant species (Cabido et al. 2018). These forests are classified as primary when

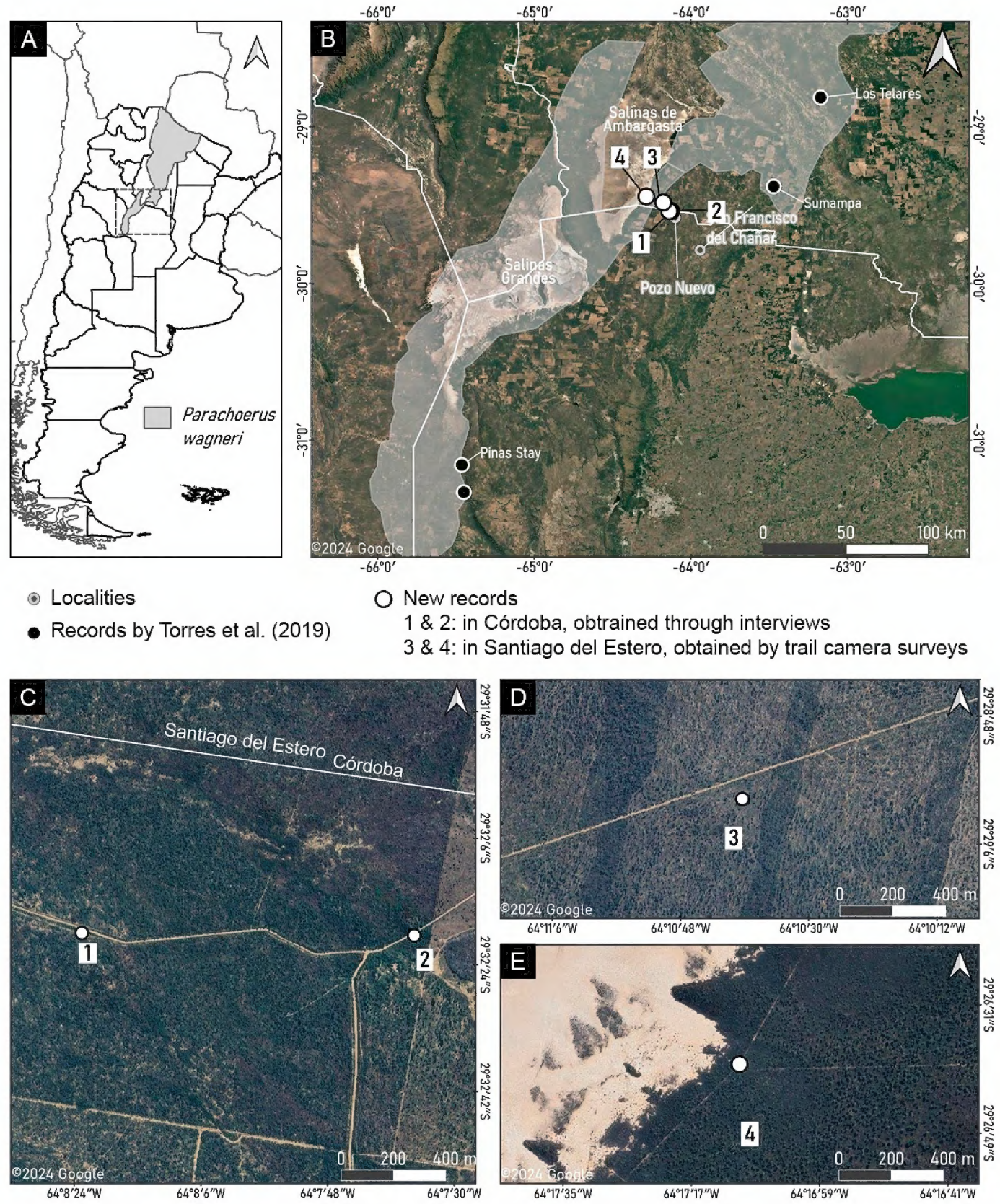

Figure 1. Study area and new records in Córdoba and Santiago del Estero, Argentina. **A.** Argentina map, marked in dark gray distribution of *Parachoerus wagneri* (Camino and Torres 2019). **B.** Zoom on the border of Córdoba and Santiago del Estero, sites of new records. **C.** Zoom on records 1 and 2. **D.** Zoom on record 3. **E.** Zoom on record 4.

they maintain trees reaching ≥12 m in height, and as secondary when they have largely lost the upper canopy, resulting in a lower average height (Torres et al. 2019; Camino et al. 2022). Additionally, salt-pan shrublands are included where *Allenrolfea patagonica* (Moq.) Kuntze, *Cyclolepis genistoides* Gillies ex D. Don, *Maytenus vitis-idaea* Griseb., *Suaeda divaricate* Moq., and *Atriplex argentina* Speg. dominate; succulent, spiny shrubs up to 1 meter tall, adapted to saline soils and arid conditions (Cabido et al. 2018).

Our study area is characterized by extensive native forests, low agricultural productivity, and dominance of low-intensity cattle ranching (Vallejos et al. 2020). Within these territories, local peasant communities coexist with silvopastoral livestock systems, resulting in varying levels of intensity (Marquez et al. 2022). In their territories, local peasant families have developed diversified forest use systems centered on the use of native vegetation and animals. The systems integrate livestock (e.g., goats, cows, horses, and chickens), firewood collection, and hunting, activities deeply rooted in their traditional knowledge and connection to the environment (Bocco et al. 2007; Camino et al. 2018; Jiménez Escobar 2019). In contrast, silvopastoral systems are managed and inhabited by salaried local employees, as landowners typically reside elsewhere. These systems involve clearing woody vegetation, leaving only large trees, and maintaining higher densities of cattle that primarily fed on exotic grasses (Marquez et al. 2022). Of the 14 private farms included in our study, eight are peasant systems where primary and secondary forests blend. Three are silvopastoral systems, with grassland areas and curtains of primary and secondary forest. The remaining three were once silvopastoral farms but have been abandoned or inactive for the past seven years, with secondary forest now predominating. Additionally, 10 of the 14 farms have areas bordering the Salinas, which are characterized by halophilic shrublands.

Fieldwork was carried out following the guidelines established by the Code of Ethics of the Latin American Ethnobiology Society (SOLAE Ethics Committee et al. 2018) throughout the study. We conducted semi-structured interviews with local residents on wildlife presence and abundance between April 2023 and June 2024. The interviewees were selected using the snowball sampling method. However, the interview marked the culmination of a process of continuous exchanges and trust-building between the researchers and local residents. In this way, participatory sampling allowed the interviewees themselves to guide us to meet people who had close contact with *P. wagneri* (Bernard 2006; Braga-Pereira et al. 2021; Zayonc and Coomes 2022).

During these interviews, we showed printed photographs of 47 medium-sized and large terrestrial vertebrates (weighing more than 1 kg) whose distribution includes or is near the study area. A photograph of *P. wagneri* was placed next to one of *Dicotyles tajacu*, which also inhabits the study area, to allow for a comparison of the species' distinctive characteristics. Additionally, we conducted in-depth interviews with five individuals who had direct contact with *P. wagneri* within the last year, and photographic evidence of such encounters was requested whenever possible. From the interviews, only those with photographic evidence of *P. wagneri* were presented as records.

Simultaneously, 13 trail cameras (two Smart Tech DL001 16MP 1080p, six Hawkray Trail Cameras 20MP 1080P, one Bushnell Prime Low Glow 119932CB, 24MP 480p, and four Bushnell CORE S-4K No Glow 30 mp--119949C4) were progressively deployed from June 2023 to the present, placed at a minimum distance of 1 km from each other (Silveira et al. 2003). The devices were placed in locations chosen collaboratively by the researchers and local residents, who, thanks to their deep knowledge of the area, guided us to spots where wildlife presence was most frequently observed. Likewise, during joint placements, local residents were able to identify suitable sites for the cameras by analyzing tracks, hairs, ground scratches, and other signs. These locations included primary and secondary forests, salt-pan shrubland, along transects, near dams, animals burrow systems (e.g. from *Lagostomus maximus* (Desmarest, 1817), Plains Vizcachas), and other strategic wildlife corridors, in locations with good visibility. Cameras were attached to a tree trunk at a height of approximately 50 cm from the ground (Hurtado and Soto 2017). The cameras were set to operate 24 h per day, taking three consecutive photographs at intervals of 59 s, or until new movement was detected. Each camera location was georeferenced.

Specimen identification was determined by comparing and analyzing morphometrics data, coloration, figures, drawings, and photographs from description and taxonomic information by Mayer and Wetzel (1986), Torres and Tamburini (2018), and Camino and Torres (2019). The geographic range of *P. wagneri* (Figure 1A) was obtained from the Camino and Torres (2019). Coordinates and elevation were recorded in the field using a Locus Map application. These points are shown on the satellite image from Google Maps (Google 2024). The final map (Figure 1) was constructed using QGIS (QGIS Development Team 2024). Data from old records were obtained from the scientific literature (Torres et al. 2019).

RESULTS

***Parachoerus wagneri* (Rusconi, 1930)**

Figures 1, 2

We conducted 28 interviews with local family groups and accumulated 2,611 camera days across 62 sampling stations. As result, we obtained four records of *P. wagneri*. Two of these records (1 and 2) came from photographs showed by hunters who had photographical evidence and provide us with the precise location of the

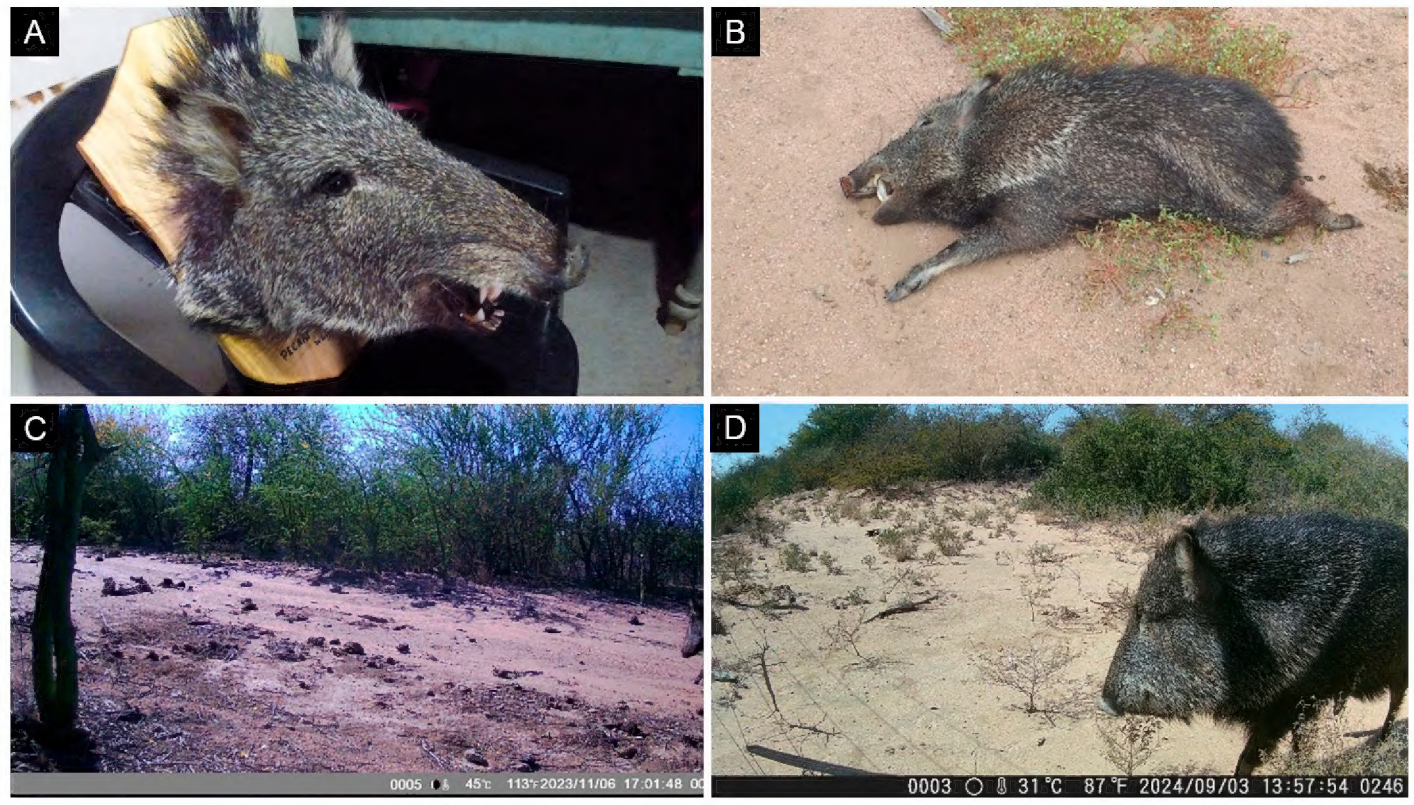

Figure 2. New records of *Parachoerus wagneri*. **A.** Head of a hunted individual, preserved by taxidermy techniques. **B.** Photograph of individual hunted. **C.** Individual photographed by trail cameras in deforested area. **D.** Second individual photographed by camera trapping in halophilic shrubland.

hunting episode (Figure 2A, B). The other two records (3 and 4) were obtained through trail cameras (Figure 2C, D). No physical evidence of the species was removed from the territory, and therefore, it was not deposited in any institution.

New records. ARGENTINA — Córdoba • Sobremonte department; 29°32′19.81″S, 064°07′35.68″W; 342 m alt.; Oct. 2023; interviewee obs.; 2 adult male/female, 2 juvenile sex indet.; secondary forest • Sobremonte department; 29°32′19.47″S, 064°08′22.92″W; 333 m alt.; Nov. 2023; interviewee obs.; 1 male adult.; secondary forest — Santiago del Estero • Ojo de Agua department; 29°28′59.64″S, 064°10′39.32″W; 248 m alt.; 11 Jun. 2023; M. Wajner obs.; 1 adult, sex indet.; deforested habitat • Ojo de Agua department; 29°26′39.51″S, 064°17′10.02″W; 122 m alt.; 3 Sep. 2024; M. Wajner obs.; 1 adult, sex indet.; salt-pan shrubland.

The records reported in this study are 65 km from the nearest known record to the east (Sumampa; 29°22′49.76″S, 063°28′21.61″W) and 220 km from the nearest known record to the south (Estancia Pinas; 31°09′30.08″S, 065°27′47.91″W) (Figure 1; Torres et al. 2019).

The presence of *P. wagneri* in the study area was mentioned in nine of the interviews we conducted. In five of them, local people reported observations of Chacoan Peccaries within the last year. The interviewee who reported record #1 observed a herd of four individuals, two adults, and two juveniles. He showed us a photograph of the taxidermized head of one of the adult males. The interviewees stated that this species is named as "Collarejo," "Rosillo," "Moro," "Penquero," or "Quimilero". They also mentioned the species for nearby areas (e.g. near the town of Pozo Nuevo, 29°34′45″S, 064°06′05″W, and near to San Francisco del Chañar, 29°47′14″S, 063°56′32″W; Figure 1). This area represents a zone of ecological transition between the plains of the Arid Chaco and the nearby mountain ranges (Martino et al. 2020).

Identification. We identified the animals photographed by trail cameras, as well as those provided by local people, as *P. wagneri* (Figure 2) based on their external characteristics: long dorsal bristles, light colored shoulders, and upper neck. The head is different shape, proportionally, and with the eyes closer to the ears, along with longer ears and legs, than in *P. tajacu* (Torres and Tamburini 2018). In both the photograph and the skull (which was photographed by researchers; Figure 2A) presented by local inhabitants, the teeth of this *P. wagneri* individual were noticeably wider and larger than those of *P. tajacu*. The identification of the species from the photographs was additionally confirmed by two specialists who we contacted, Gabriel Boaglio and Dr. Ricardo Torres.

DISCUSSION

The evidence we present here confirms the presence of *Parachoerus wagneri* in the Sobremonte department of Córdoba province and the Ojo de Agua department of Santiago del Estero province, two areas where the species had not been previously recorded (Torres et al. 2019). These new records reinforce the idea that *P. wagneri* may live in both primary and secondary forests (Torres et al. 2019; Camino et al. 2022). Moreover, our findings provide a foundation for investigating how these animals utilize the edges of salt flats, particularly in areas dominated by halophilic shrubland. On the other hand, the fact that the herd observed by one of the local hunters included both adult and juvenile individuals suggests that the species is breeding in the area. We speculate that the forests along the edges of the Salinas de Ambargasta salt pan could serve as corridors connecting populations in northern and central Argentina. In contrast, the large areas of intensive agriculture in the eastern part of the study area could act as a barrier, as these animals typically avoid highly disturbed forests (Camino et al. 2022).

Our findings suggest two key points. First, we show that *P. wagneri* is able to live and reproduce in habitats with some anthropogenic disturbance, and second, participatory sampling provides high-quality data in these areas (Marquez et al. 2023; Wajner et al. 2023, 2024a, 2024b). Participatory sampling is a valuable tool for the adding knowledge of the habits of *P. wagneri*. It is a reliable and effective method for collecting data on scarce or migratory species (Camino et al. 2020; Zayonc and Coomes 2022). In addition, the inclusion of local communities in conservation activities not only improves the quality of the data collected but also encourages more collaborative decisions about land management (Camino 2016; Braga-Pereira et al. 2021).

In conclusion, this finding significantly enhances our understanding of the distribution of *P. wagneri* and offers new insights into the potential corridors used by its populations. This knowledge is vital for a species that relies heavily on forests for survival and faces a latent risk of extinction (Camino et al. 2023).

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: MW, FM, DA, FZ. Data curation: MW, FM. Formal analysis: MW, FM, DA, FZ. Funding acquisition: MW, FZ. Investigation: MW, FZ. Methodology: MW, FM, FZ. Resources: MW. Supervision: MW, FZ. Visualization: MW, FM. Project administration: MW, FZ. Software: DA. Validation: MW, FM. Writing – original draft: MW, FM, DA, FZ. Writing – review and editing: MW, FM, DA, FZ.

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Data availability

All data that support the findings of this study are available in the main text.

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